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RESEARCH ARTICLE

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Global and Regional IUCN Red List Assessments: 1

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Abstract

In this contribution, the conservation status assessment of six plant species according to IUCN categories and criteria are presented. It includes the assessment at global level of *Linaria tonzigii* Lona, *Allium garganicum* Brullo, Pavone, Salmeri & Terrasi, *Ferula arrigonii* Bocchieri, *Orchis patens* Desf. subsp. *patens* and *Armeria saviana* Selvi and the assessment at regional level (Italy) of *Viola jordanii* Hanry.

Keywords

Conservation, extinction risk, IUCN protocol, threats

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How to contribute

The text of the national and global assessment should be submitted electronically to Simone Orsenigo (Simone.Orsenigo@unimi.it) or to Giuseppe Fenu (gfenu@unica.it); text up to 8000 characters in length (space included) must include a distribution map and a picture of the assessed species.

Red List assessments

Linaria tonzigii Lona

Global assessment
Taxonomy and nomenclature
Order: Lamiales *Family:* Plantaginaceae

Linaria tonzigii Lona, Natura (Milano) 40: 66 (1949)

Common name: Linajola bergamasca (Italian)

Geographic distribution range: *Linaria tonzigii* (Fig. 1) is an Italian endemic distributed in the Orobic southern Alps (Lombardy). The species is recorded for Pizzo Arera, Cima di Menna, Monte Ferrante and Monte Pegherolo (Crescini et al. 1983, Tagliaferri 1992; Fig. 2).

Distribution: Countries of occurrence: Italy

Biology: *Plant growth form:* perennial (hemicryptophyte)

Flowering time: from July to August depending on the altitude

Reproduction: no information on pollination, dispersal strategy nor seed germination is available.

Habitat and ecology: *Linaria tonzigii* grows exclusively on calcareous rocks (Esino Limestone). It is typical of unstable limestone screes between 1,600 and 2,400 m a.s.l. and is attributable to the alliance *Thlaspion rotundifolii* Jenny-Lips 1930.

Population information: There is no detailed information available on population dynamics; however, due to its habitat, the population trend and the number of mature individuals can be considered stable.

Threats: *1.3. Tourism and recreational areas:* the easternmost populations are threatened by projects aimed at developing and connecting skiing areas.

5.2.1. Gathering terrestrial plants, Intentional use: the plant is collected by botanists and amateurs for herbarium sheets.

6.1. Recreational activities: some populations grow on trails used by hikers and are, therefore, threatened by human trampling.

11.1. Habitat shifting & alteration: the plant is potentially threatened by natural habitat evolution (growth of grass and shrubs on partially stabilized debris); this process is particularly evident at lower altitudes.

Figure 1. *Linaria tonzigii* Lona in its *locus classicus* on Pizzo Arera (2000 m a.s.l., Bergamo, Italy). Photograph by S. Orsenigo.

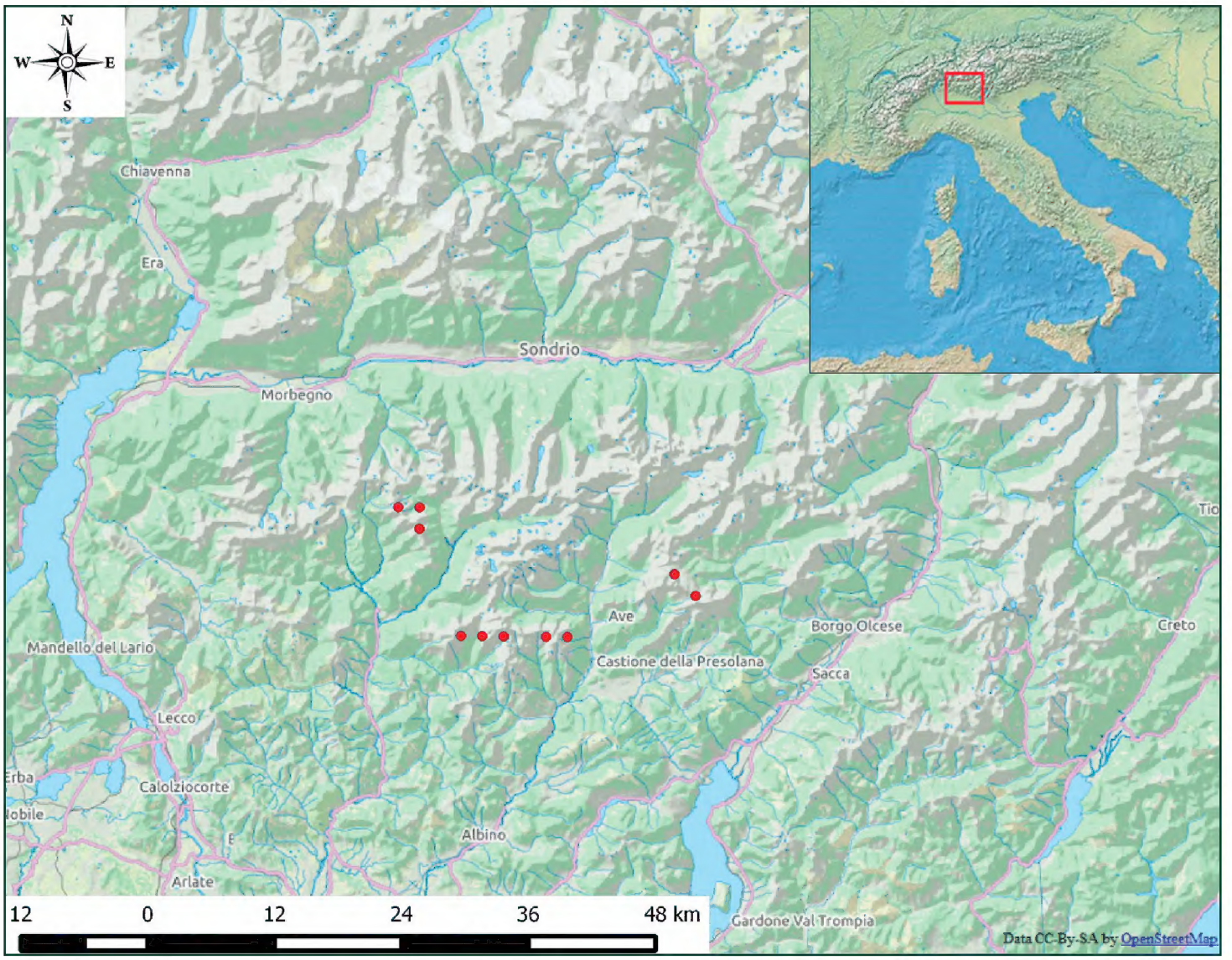

Figure 2. Geographic range and distribution map of *Linaria tonzigii*.

CRITERIA APPLIED:

Criterion B: **EOO:** 190 km² calculated with minimum convex hull in QGis 2.0
AOO: 40 km² calculated with a 2×2 km cell fixed grid

Decline: no documented decline in number of mature individuals, number of subpopulations, quality of the habitat, AOO, and EOO.

Red List category and Criteria (Global Assessment)

NT	**Near Threatened**

Rationale for the assessment: *Linaria tonzigii* is an Italian endemic that is found in the southern calcareous Alps of Lombardy. It has an extent of occurrence of 190 km² and an area of occurrence of 40 km². The species occurs in four principal nuclei at altitudes ranging between 1,600 and 2,400 m a.s.l. (Martini et al. 2012). The populations are stable and not severely fragmented, however, the plants are potentially threatened by natural habitat evolution, human trampling, and by the expansion of skiing areas. Loss of any of the known populations could result in a sufficiently significant decline to make it eligible for a threat class. For these reasons, this species is

classed as Near Threatened with the expectation that it will be assigned to Endangered B1ab(iii)+B2ab(iii) if any populations are lost.

Previous assessment: at a global level, the species was previously assigned to the following categories: EN (D) in Bilz et al. (2011) and to NT in Rossi et al. (2015).

Conservation actions: *Linaria tonzigii* is listed in Annexes II and IV of the Habitats Directive 92/43/CEE and under Appendix I of the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention). The species is protected by a Regional Law (LR 10/2008, Lombardy Administrative Region). Some seed samples are stored *ex situ* at the Millennium Seed Bank (Royal Botanic Garden, Kew, UK).

Conservation actions needed: further monitoring and research activities are recommended in order to better understand its reproductive biology, which is currently almost unknown, and to plan translocation programmes if the skiing area projects will be executed.

Simone Orsenigo

Allium garganicum Brullo, Pavone, Salmeri & Terrasi

Global assessment

Taxonomy and nomenclature

Order: Asparagales *Family:* Amaryllidaceae

Allium garganicum Brullo, Pavone, Salmeri & Terrasi, Plant Biosyst. 143(suppl.): 78–84 (2009)

Common name: Aglio del Gargano, Aglio garganico (Italian)

Geographic distribution range: *A. garganicum* (Fig. 3) is an Italian endemic found in Apulia Region, in two different areas, the Gargano promontory and the Murge plateau. In Gargano, the species is recorded in the *locus classicus* near Peschici (Brullo et al. 2006, 2007, 2009), where we collected it in Monte Pucci, between Peschici and Vieste in Crovatico (MJG-*Herbarium Garganicum*), in Montenero at about 950 m a.s.l. (MJG-*Herbarium Garganicum*), and NNW of Manfredonia between Posta Manganaro and Scaloria (Perrino and Wagensommer 2012). In the Murge plateau the species is recorded near Santeramo in Colle (Perrino et al. 2013) (Fig. 4). Other sites indicated in Perrino and Wagensommer (2012) between Peschici and Mattinata (Torre Porticello, Molinella, Torre Usmai, Torre Calalunga, San Lorenzo, Torre del Segnale) are probably due to confusion with *Allium apulum* Brullo, Guglielmo, Pavone & Salmeri. It is possible that the reports sub *Allium flavum* L. from Gargano (Vieste, Cagnano, Vallone di Pulsano; see Fenaroli 1974) and from the Murge plateau (Bosco Jannuzzi alle Murge di Toritto, Pulicchio di Gravina; see Bianco 1962) have to be attributed to *A. garganicum*.

Figure 3. *Allium garganicum* Brullo, Pavone, Salmeri & Terrasi at a site NNW of Manfredonia (Apulia). Photograph by E.V. Perrino.

Distribution: Countries of occurrence: Italy
Biology: *Plant growth form:* perennial (geophyte)
Flowering time: from early June to late July
Reproduction: no information on pollination, dispersal strategy and seed germination is available

Habitat and ecology: *A. garganicum* grows on limestones, not only near the coast as in the *locus classicus*, but also at higher altitudes (in Montenero at almost 1000 m a.s.l.). At lower altitudes the species is usually a member of stony or rupestrian xerophilous grasslands dominated by *Brachypodium retusum* (Pers.) P.Beauv., attributed to the *Stachyo fragilis-Brachypodietum retusi* C. Brullo, S. Brullo, Giusso & Tomaselli 2006 of the alliance *Thero-Brachypodion ramosi* Br.-Bl. 1925 (Brullo et al. 2006, 2009). At higher altitudes it occurs in xerophilous communities.

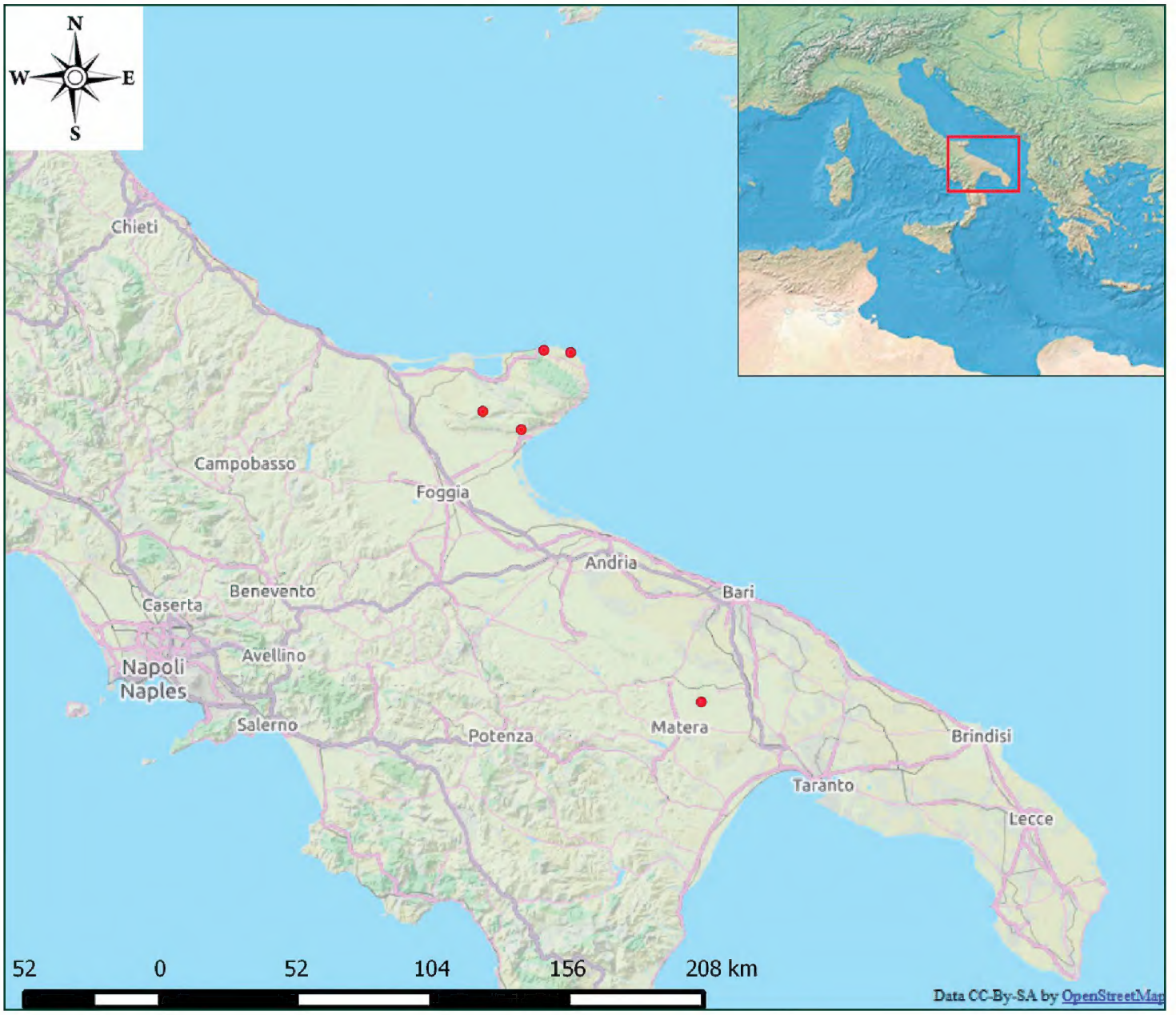

Figure 4. Geographic range and distribution map of *Allium garganicum*.

Population information: There is no detailed information available on population dynamics.

Threats: *2.3.1 Nomadic grazing:* the habitat of the species is sometimes affected by grazing.

6.1 Recreational activities: the populations near the coast (Peschici and Vieste) are affected by tourism in the summer, and threatened by human trampling during flowering and fruiting seasons.

7.1.1 Increase in fire frequency/intensity: an increase in fire frequency or intensity would negatively affect the populations.

12.1 Other threats (natural succession): natural succession, favoured by the occurrence of the populations in protected areas, represents a serious danger for the habitat conservation.

CRITERIA APPLIED:

Criterion B: **EOO:** 2938 km^2 calculated with minimum convex hull (with Google Earth Pro)
AOO: 20 km^2 calculated with a 2×2 km cell fixed grid

a) Number of locations: five (according to threats 6.1 and 12.1)
b) Decline expected in EOO (i), AOO (ii), area, extent and quality of the habitat (iii), number of subpopulations (iv), number of mature individuals (v).
Category: EN B1ab(i,ii,iii,iv,v)+2ab(i,ii,iii,iv,v)

Criterion D: **AOO:** 20 km^2 calculated with a 2×2 km cell fixed grid
Number of locations: five (according to threats 6.1 and 12.1)
Plausible future threat that could drive the taxon to CR in a very short time: yes
Category: VU D2

Red List category and Criteria (Global Assessment)

EN	**Endangered**	**B1ab(i,ii,iii,iv,v)+2ab(i,ii,iii,iv,v)**

Rationale for the assessment: *Allium garganicum* is an Italian endemic that is found only in the Region of Apulia. It has an EOO of 2,938 km^2 and an AOO of 20 km^2. Recent data indicates that the species occurs on five sites, four of them in the Gargano promontory and one in the Murge plateau, corresponding to five locations according to threats 6.1 (recreational activities) and 12.1 (natural succession). The subpopulations consist of very few individuals. Due to the identified threats, a decline is expected in EOO, AOO, area, extent and quality of the habitat, number of subpopulations, and number of mature individuals.

Previous assessment: at a global level, the species was not evaluated (NE) previously (Bilz et al. 2011, IUCN 2016).

Conservation actions: *Allium garganicum* is unprotected by international, national, and regional laws. Neither seed nor bulb collections exist in germplasm banks.

Conservation actions needed: research activities and a monitoring programme are recommended in order to better understand the reproductive biology and the population trend of the species, and in order to evaluate the effects of human activities on the subpopulations, especially those located in touristic areas. *Ex situ* gene resource banking is recommended, for possible plant translocation programmes aimed at increasing the very low number of individuals in the subpopulations.

Robert Philipp Wagensommer, Enrico Vito Perrino, Giuseppe Nicola Silletti, Wolfgang Licht

Ferula arrigonii Bocchieri

Global assessment
Taxonomy and nomenclature
Order: Apiales *Family:* Apiaceae

Ferula arrigonii Bocchieri, Boll. Soc. Sarda Sci. Nat. 26: 309 (1988)

Common name: Ferula di Arrigoni (It); Férule d'Arrigoni (Fr); Fennel of Arrigoni (En)

Geographic distribution range: *Ferula arrigonii* (Fig. 5) is endemic of the Sardo-Corsican biogeographical province (Fenu et al. 2014); its distribution consists of 14 populations located in Sardinian coastal environments and only one population in Corsica (Fig. 6). The Sardinian populations (Bocchieri 1988, Dettori et al. 2014a) are located in the southeastern part of the island (Isola di Serpentara and Isola dei Cavoli), on the southwestern coasts (San Nicolò di Buggerru, Pranu Sartu and Capo San Marco), in the northwest (Capo Caccia and Isola Piana) and in the northeast (Isola di Tavolara, Isola di Razzoli, Isola di Budelli, Isola di Paduleddi, Abbatoggia, Isola di Santo Stefano and Capo Testa). The only Corsican population, originally reported in Camarda (1992), was located near Bonifacio (southern Corsica) and was studied in detail by Paradis and Piazza (2004).

Distribution: country of occurrence: Italy (Sardinia) and France (Corsica)

Biology: *Plant growth form:* perennial (rhizomatous geophyte)

Flowering and fruiting time: flowering from late April to June and fruiting in July

Reproduction: no information is available on pollination, dispersal strategy, and seed germination.

Habitat and ecology: *Ferula arrigonii* grows in coastal areas directly exposed to the marine aerosol, mainly on small islands, either on rocky cliffs and without an apparent substrate preference (Bocchieri 1988, Dettori et al. 2014a). The plant communities to which the species participates are the *Crithmo maritimi-Staticion* Molinier 1934 and, secondarily, the *Teucrion mari* Gamisans *et* Muracciole 1984 alliances.

Population information: There is no detailed information available on population dynamics. However, due to its habitat, the population trend and the number of mature individuals can be considered stable.

Threats: *1.1 Housing & Urban areas:* the Corsican population is located in a natural area inside the city of Bonifacio, but future urban developments (i.e., construction of roads, buildings, and parking areas) could represent a potential threat to the population.

6.1. Recreational activities: some populations grow in or near touristic localities (e.g., Isola dei Cavoli, Capo San Marco, Capo Caccia, Capo Testa and Isola di Tavolara) with many visitors during the summer, and could, therefore, be affected by human trampling.

CRITERIA APPLIED:

Criterion B: **EOO:** 22,960 km^2 calculated with minimum convex hull in ArcGis 2.0
AOO: 60 km^2 calculated with a 2×2 km cell fixed grid

Decline: no documented decline in EOO, AOO, number of subpopulations, quality of the habitat, and number of mature plants.

Red List category and Criteria (Global Assessment)

LC	**Least Concern**

Figure 5. *Ferula arrigonii* Bocchieri in its *locus classicus* on Isola di Serpentara (Sardinia). Photograph by G. Bacchetta.

Rationale for the assessment: *Ferula arrigonii* is a Corso-Sardinian endemic forming 15 distinct populations, mainly concentrated in Sardinia. It has an extent of occurrence of ca. 23,000 km^2 and an area of occurrence of 60 km^2. The populations are

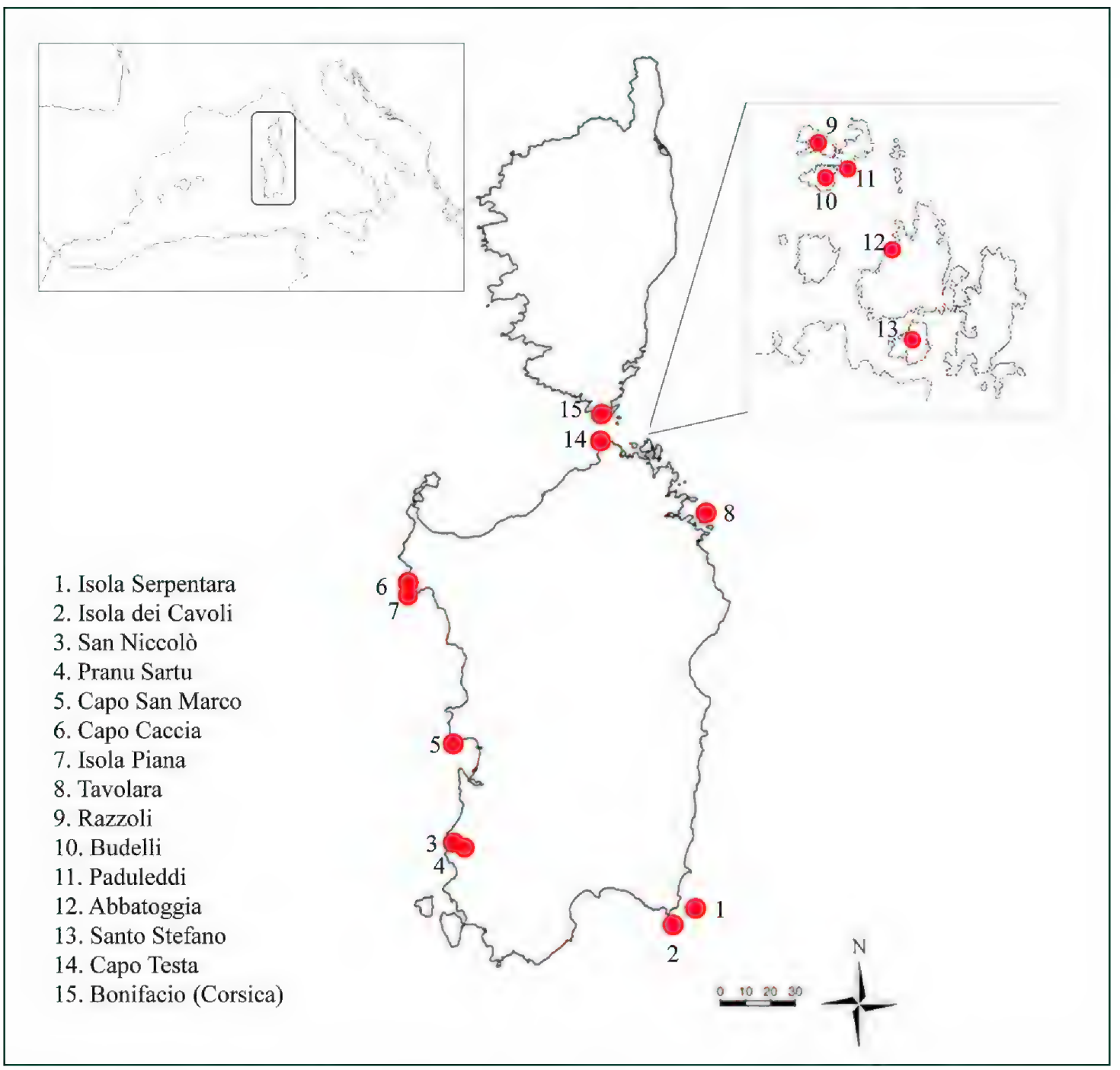

Figure 6. Geographic range and distribution map of *Ferula arrigonii*.

generally stable and no severe threats affect this plant; the single Corsican population is the only potentially threatened one by the expansion of urban areas. The threat analysis shows no real risks of decline for populations, even those located in tourist areas. For this reason, this plant is considered as Least Concern at a global level.

Previous assessment: the species was previously assigned to the following categories at regional level: Lower Risk (LR) in Conti et al. (1997) and Least Concern (LC) in Dettori et al. (2014a); at a global level the species was previously not evaluated (NE) (IUCN 2016).

Conservation actions: *Ferula arrigonii* is unprotected by international, national, and regional laws. Seeds collected from ten Sardinian populations were stored *ex situ* at the Sardinian Germplasm Bank (BG-SAR, Cagliari, Italy); *duplicata* of these were also sent to the Millennium Seed Bank (Royal Botanic Garden, Kew, UK).

Conservation actions needed: research activities are recommended in order to better understand the species' reproductive biology; monitoring programmes aimed

at evaluating the effects of human activities on populations, especially the Corsican population and those located in touristic areas, are recommended.

Notes: *F. arrigonii* was for a long time considered a naturalized species of Sardinian provenance (Jeanmonod and Gamisans 2013). An introduction to Corsica from Sardinia was initially hypothesized by Paradis and Piazza (2004); these authors also suggested, as an alternative hypothesis, that the species could have diversified in ancient times, that it was once more widespread and that its distribution is currently declining. A recent genetic study carried out on nine populations, covering the whole distribution range of this plant (Dettori et al. 2014b), indicated that it is uncertain that the Corsican population is the result of an introduction from Sardinia. Rather, the high values of genetic diversity suggest that *F. arrigonii* was once more widespread than it is at present and that the existence of larger populations in the past could partially explain the current high levels of genetic diversity at specific level (Dettori et al. 2014b). These findings suggest that particular attention should be paid to the Corsican population when conservation strategies are planned, since it is probably of natural origin, and, therefore, has a high conservation value *per se* (Dettori et al. 2014b).

Giuseppe Fenu, Donatella Cogoni, Maria Silvia Pinna, Gianluigi Bacchetta

Armeria saviana Selvi

Global Assessment

Taxonomy and nomenclature

Order: Caryophyllales *Family:* Plumbaginaceae

Armeria saviana Selvi, Nordic J. Bot. 27(2): 126. 2009

Common name: Armeria di Savi (It)

Geographic distribution range: *A. saviana* (Fig. 7) is endemic of the M. Amiata massif (Tuscany, Italy); currently six subpopulations have been located (M. Labbro; Poggio all'Olmo; M. Aquilaia; M. Buceto; Poggio Le Volturaie; Poggio La Torretta; Fig. 8).

Distribution: country of occurrence: Italy

Biology: *Plant growth form:* perennial (hemicryptophyte)

Flowering and fruiting time: *A. saviana* flowering from May to June and fruiting in July

Reproduction: no information on pollination, dispersal strategy and seed germination is available

Habitat and ecology: *A. saviana* grows in xerophilous herbaceous communities characterized by low cover typical of the stony pastures or on the rocky slopes with slight declivity, at an altitude of 900-1000 m a.s.l. It prefers the calcareous soil but it can occur also on the arenaceous-marl substratum (Angiolini and De Dominicis, 1999, Selvi 2009, 2010).

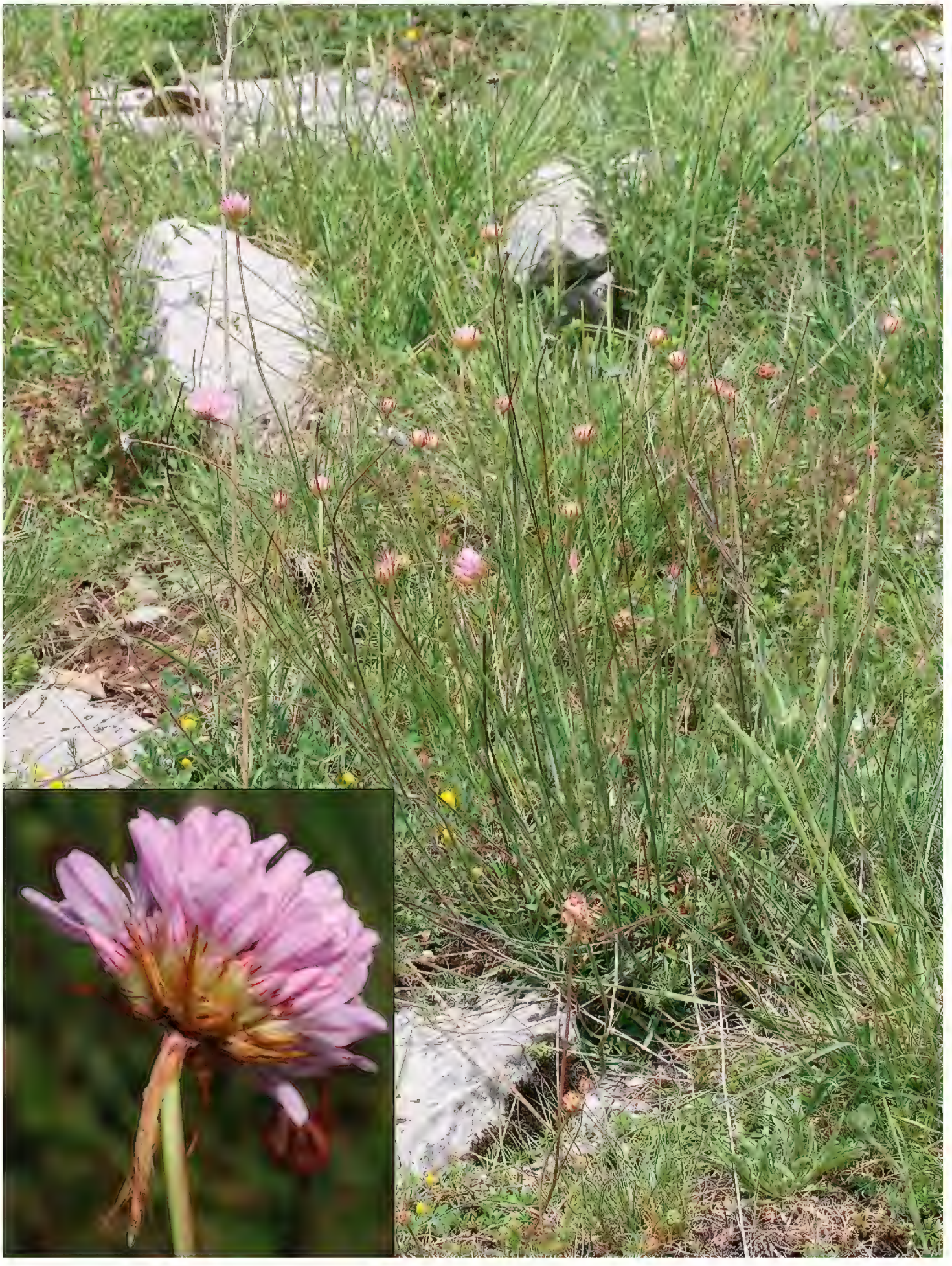

Figure 7. *Armeria saviana* Selvi in Monte Labbro (Tuscany). Photograph by F. Selvi.

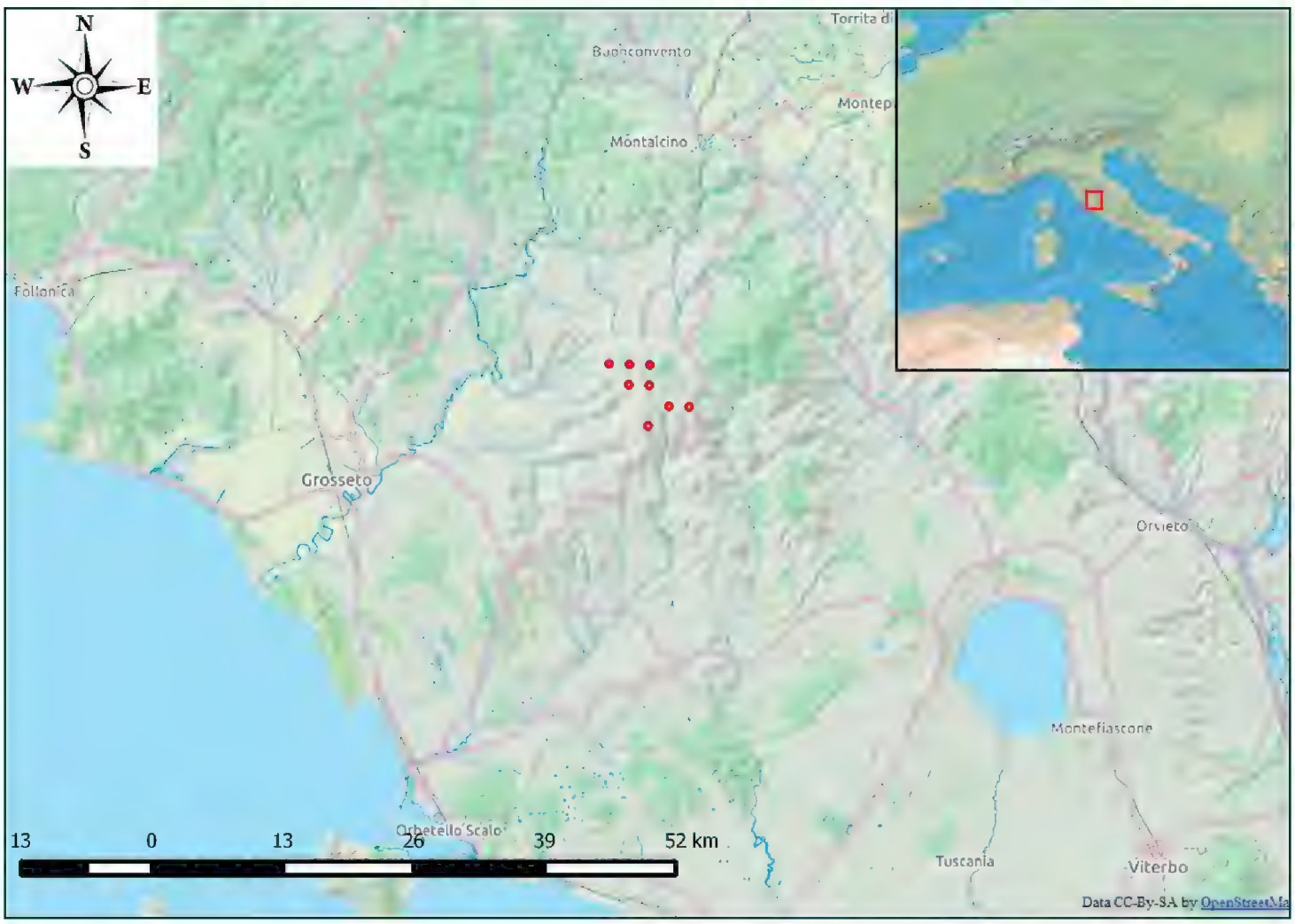

Figure 8. Geographic range and distribution map of *Armeria saviana*.

Population information: there is no detailed information available on population dynamics, trend and the number of mature individuals.

Threats: *7.3 Other ecosystem modifications*: in the last decades, a reduction in grazing activity has led to the closure of the habitat and represents a serious threat for its conservation.

CRITERIA APPLIED:

Criterion B: **EOO:** 32 km^2 calculated with minimum convex hull in QGis 2.0
AOO: 32 km^2 calculated with a 2×2 km cell fixed grid

a) Number of locations: five locations (Poggio La Torretta, M. Buceto, Poggio all'Olmo-M. Aquilaia, Poggio Le Volturaie and M. Labbro) have been identified according to threat 7.3

b) Decline in extent and quality of the habitat (iii)

Red List category and Criteria (Global Assessment)

EN	**Endangered**	**B1ab(iii)+2ab(iii)**

Rationale for the assessment: *A. saviana* is an endemic plant threatened by habitat loss: it has an extent and area of occurrence of ca. 32 km^2. The populations are generally constituted by few individuals and although no severe threats affect these plants, the considerable decrease in grazing activity entails habitat reduction.

Previous assessment: *A. saviana* was not evaluated (NE) previously (IUCN 2016).

Conservation actions: *A. saviana [sub A. denticulata* (Bertol.) DC] is protected at regional level (LR 56/2000) but not by any international or national laws. Some stations are included in the SCI IT51A0018 "Monte Labbro e Alta Valle dell'Albegna" as defined in the European Habitats Directive (92/43/EEC).

Conservation actions needed: further monitoring and research activities are recommended in order to better understand the reproductive biology and population trend of the species.

Matilde Gennai, Daniele Viciani

Orchis patens Desf. subsp. *patens*

Global assessment

Taxonomy and nomenclature

Order: Orchidales *Family:* Orchidaceae

Orchis patens Desf. Fl. Atlant. 2: 318 (1799)
= *Orchis brevicornis* Viv., Ann. Bot. (Genoa) 1(2): 184 (1804)

Common name: orchidea patente (Italy), orchis ouvert (Tunisia), orchis étalée (Algeria), green spotted orchid (UK)

Geographic distribution range: the distribution range of *Orchis patens* (Fig. 9) is still under debate, due to unresolved taxonomic issues (see *Notes*). According to different authors, this species could be considered endemic (western Mediterranean endemism occurring in NW Italy and North Africa) or subendemic of the Mediterranean basin (occurring also in the Canary Islands, except Fuerteventura and Lanzarote). Molecular analyses should resolve the issue. In the meantime, the present assessment concerns the Mediterranean populations of the species *O. patens* subsp. *patens*. *O. patens* subsp. *patens* has a peculiar and strongly fragmented distribution. It occurs in NW Italy (Liguria administrative region) and in several sites of the Tell Atlas in North Africa (Fig. 10), mostly in Algeria and partially in Tunisia, where the species has been found again only in recent times (Martin et al. 2015).

Distribution: Countries of occurrence: Italy, Algeria, Tunisia

Biology: *Plant growth form*: perennial (bulbous geophyte)

Flowering time: from April to May (June), depending on altitude

Reproduction: investigations on seed germination and pollination strategy are in progress.

Habitat and ecology: *O. patens* subsp. *patens* grows in open habitats with high or medium brightness, such as rocky grasslands, clearings, and scarcely dense woods of chestnut (*Castanea sativa* Mill.), oak (*Quercus* sp. pl.) or cedar trees (*Cedrus atlantica* (Endl.) Carrière), including cultivated olive tree groves (*Olea europaea* L.). The species lives both on limestone

Figure 9. Flower spike of *Orchis patens* Desf. subsp. *patens*. Photograph by J. Calevo.

Figure 10. Geographic range and distribution map of *Orchis patens* subssp. *patens*.

and siliceous substrates. Currently, it occurs both at the edge of cities, in rural areas (in Italy), and in natural environments. Its altitudinal range goes from 100 to 1,700 m a.s.l.

Population information: *O. patens* is usually found at very low densities (less than 20 individuals per site) and is often quite rare.

Threats: *1.1 Housing & urban areas:* in the past, urban development probably brought *O. patens* subsp. *patens* close to extinction in several sites (e.g., Algiers and surroundings) and is an ongoing threat for habitat quality, causing extinction events locally (Italy).

2.1.2 Small-holder farming: locally (Italy) the biological cycle of the species is affected by inadequate agricultural practices (e.g., weeding during flowering).

2.3.1 Nomadic grazing: several sites are threatened by overgrazing (North Africa).

4.1 Road and railroads: recently the building of a new track in Algeria (near Souk-Ahras) has strongly reduced the number of individuals of the only extant population of the site (L. Boutabia Telailia, *pers. comm.*).

5.2.1 Intentional use (species is the target): due to its pretty flowers, the plant is sometimes collected (Italy). In North Africa, the tuber is used for traditional medicineand in witchcraft, and like all other tuberous orchids locally named "*al hayia wa al mayta*" (the living and the dead).

7.3 Other ecosystem modifications: the lack of adequate agricultural practices and forest management leads to closure of the habitat (Italy).

8.2 Problematic native species: in Italy, wild boars (*Sus scrofa* L.) damage the plants.

CRITERIA APPLIED:

Criterion B: **EOO:** 308730 km^2 calculated with minimum convex hull in QGis 2.2.
AOO: 168 km^2 calculated with a 2×2 km cell fixed grid.

a) The species has a severely fragmented distribution (number of locations > 10)
b) Decline in quality of the habitat (iii) and number of mature individuals (v) has been directly observed and expected to continue in the future
Category: EN B2ab(iii,v)

Criterion C: small population size (<10.000 in total), an estimated continuing decline and
a) (i) number of mature individuals in each subpopulation <1,000
Category: VU C2a(i)

Red List category and Criteria (Global Assessment)

EN	**Endangered**	**EN B2ab(iii,v)**

Rationale for the assessment: *O. patens* subsp. *patens* has a severely fragmented distribution and is characterized by quite small populations, threatened above all by the declining area and quality of suitable habitats. Several sites recorded in the past are not confirmed today, but extinction events are quite ancient and no recent decrease of the range of *O. patens* subsp. *patens* has been recorded in the last 10 years or three generations of the species. Recently, local extinctions (decrease of mature individuals) have been recorded. At global level *O. patens* subsp. *patens* (excluding Canary Islands populations) is classed as EN B2ab(iii,v).

Previous assessment: at the European level, the species was assigned to EN B1ab(iii,v) in Bilz et al. (2011); at a global level, the species was not evaluated (NE) previously (IUCN 2016).

Conservation actions: *O. patens* is listed in Appendices II (Annex B) of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and protected by local (Liguria administrative region in Italy) and national

(Algeria) laws. In Italy, the Red List assessment of *O. patens* at the national level is still in progress. Several sites of *O. patens* subsp. *patens* fall within protected areas. Preliminary taxonomic studies on its global range are in progress.

Conservation actions needed: research is required to clarify taxonomic uncertainties (species and subspecies) and further in-depth field studies are recommended to better define the distribution of *O. patens* (in particular in the Canary Islands and North Africa); a coordinated global monitoring plan and local interventions to stem threats to habitat and species, including *ex situ* conservation actions, are desirable.

Notes: for some authors, *O. patens* occurs in the Mediterranean basin as *O. patens* Desf. subsp. *patens* and in the Canary Islands as *O. patens* subsp. *canariensis* (Lindl.) Asch. & Graebn. (Euro+Med 2006; Kretzschmar et al. 2007, WCSP 2016). According to other sources, *O. canariensis* Lindley is an *O. patens* sister species (Bateman et al. 2003, Bernardos et al. 2006). Past collections of *O. patens* in the Iberian Peninsula have to be attributed to *O. cazorlensis* Lacaita or *O. spitzelii* Saut. *ex* W.D.J.Koch (Hautzinger 1978, Castroviejo et al. 2005), although further studies are necessary. *O. patens* often shares habitat and range of distribution with other closely related orchids, such as taxa of the *O. spitzelii* group (e.g., sites on the Zaccar and Meddad mountains). Hybrids of *O. patens* with *O. spitzelii* or other orchids, such as *O. provincialis* Balb. *ex* Lam. & DC., have been recorded.

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Viola jordanii Hanry

Regional assessment (Italy)
Taxonomy and nomenclature
Order: Malpighiales *Family:* Violaceae

Viola jordanii Hanry, Prodr. Hist. Nat. Var: 169 (1853)

Common name: Viola di Jordan (It); Violette de Jordan (Fr); Jordans Veilchen (De)

Geographic distribution range: *Viola jordanii* (Fig. 11) is a south European/southwest Asiatic species (Aeschimann et al. 2004), with the main distribution area centred in southeastern Europe. In Italy, it is recorded from Liguria and Friuli Venezia Giulia (Pignatti 1982, Aeschimann et al. 2004, Conti et al. 2005, Castello et al. 2015). In Liguria, *V. jordanii* is restricted to the westernmost part of the Region near the border with France, where it occurs in a single small site in the southern Maritime Alps, in the valley of Rio Giaurusso (Olivetta San Michele, IM), where it was reported for the first time by Martini (1985), and included in Natura 2000 SCI IT1315717 "M. Grammondo – Torrente Bevera". In Friuli Venezia Giulia, the species was found in 2010-2013 in four sites of the Karst area; two populations occur in the SAC IT3340006 "Carso Triestino e Goriziano" (Fig. 12). Revision of herbarium specimens revealed that *V. jordanii* has been present at one of these sites, i.e., Lake

Figure 11. *Viola jordanii* from Lake Doberdò (Friuli Venezia Giulia). Photograph by M. Castello.

Doberdò, since the 1950s (C. Zirnich's herbarium specimens collected in 1954-1956, TSM), but it was identified and reported by Cohrs (1963) as the hybrid *V. medelii* W. Becker (Castello et al. 2015).

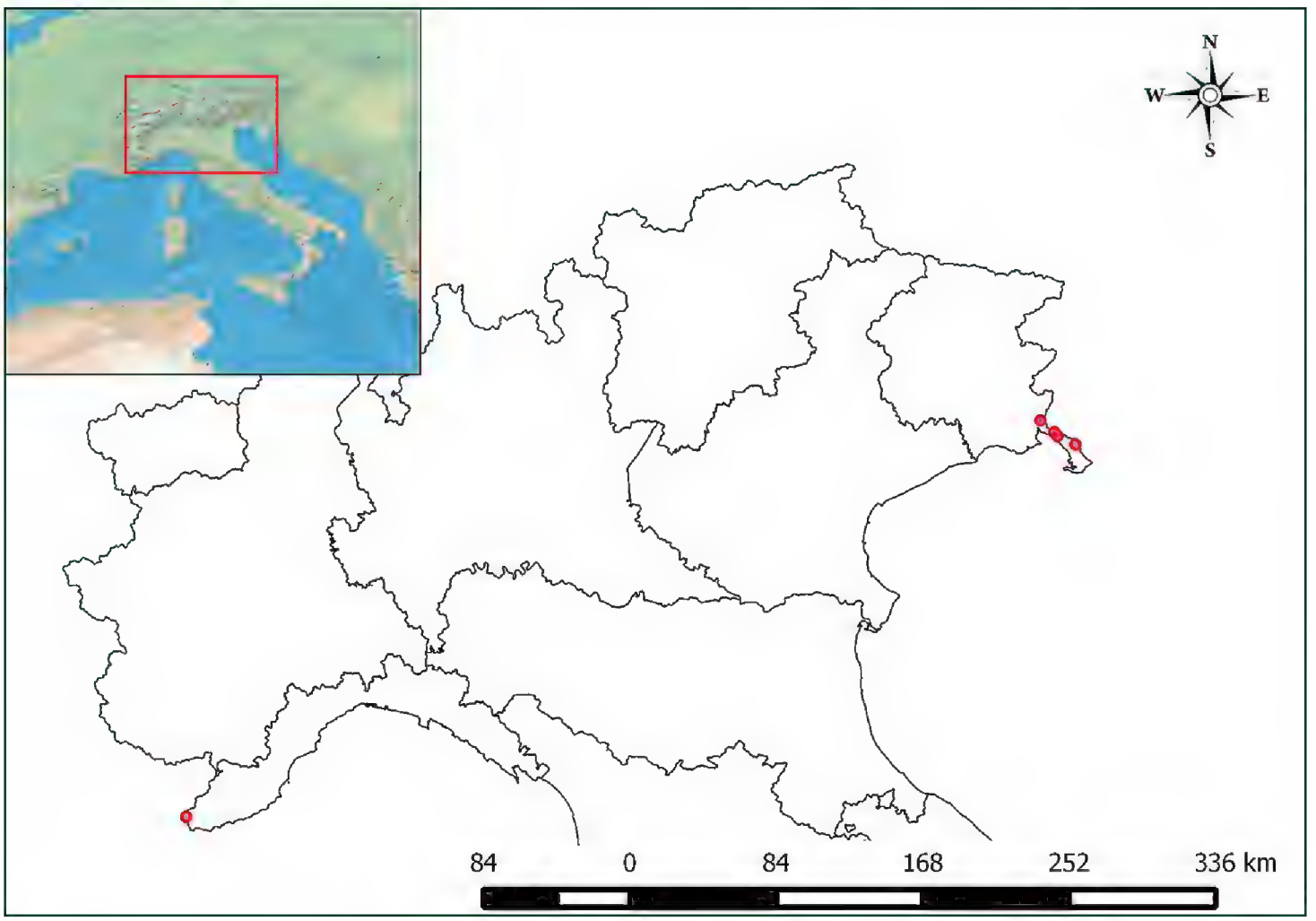

Figure 12. Distribution map of *Viola jordanii* in Italy.

Distribution: Countries of occurrence: Bulgaria, France, Greece, Hungary, Iran, Italy, Macedonia, Moldova, Romania, Serbia, Turkey, Ukraine.

Biology: *Plant growth form:* perennial (hemicryptophyte)

Flowering time: from late April to July

Reproduction: production of chasmogamous, insect-pollinated flowers and cleistogamous, self-pollinating flowers; autochorous and myrmecochorous seed dispersal (Landolt et al. 2010).

Habitat and ecology: *V. jordanii* thrives mainly in xerophile or meso-xerophile mixed oak woods, and in the mantles, hedgerows and fringes connected to them, from the plains to the hilly and lower montane belt. It is found on dry calcareous soils and brown forest soils; in eastern Europe, it also grows on loess and dry silicate soils (Aeschimann et al. 2004, Castello et al. 2015). In Italy, it occurs in mesophilous aspects of thermophilous mantles and hedgerows of the alliance *Berberidion vulgaris* Br.-Bl. 1950 and their hems, connected to the sub-Mediterranean mixed oak woods with *Quercus pubescens* Willd., and in open woods and pre-woods of *Quercus pubescens* and *Ostrya carpinifolia* Scop. (order *Quercetalia pubescenti-petraeae* Klika 1933). In the Karst region it also grows in the meso-hygrophilous margins of riparian woods with *Ulmus minor* Mill., *Fraxinus* sp. pl. and *Populus nigra* L., corresponding to the phytocoenon with *Paliurus spina-christi* Mill. and *Ulmus minor* (Poldini and Vidali 1995). It can be regarded as an ecotonal species with a mesic character; it prefers light shade or moderate light, avoiding areas of scrubs or woods where the vegetation cover becomes dense (Castello et al. 2015).

Population information: In Italy, the species is known from five small sites located in two distant regions. The estimated Italian population size is 850 individuals. There is no detailed information available on population dynamics; however, on the basis of habitat conditions, the population trend can be considered in decline.

Threats: *5.2.1 Intentional Use (species is the target)*: the species is very rare in Italy and has a certain ornamental value; it can, therefore, be threatened by intentional gathering by collectors, botanists, and/or amateurs.

6.1 Recreational activities: the plant species typically grows along paths and can be threatened by hikers (human trampling).

7.3 Other Ecosystem Modifications: the species is threatened by habitat loss arising from natural dynamic processes of shrub encroachment and regeneration of woods due to abandonment of traditional agricultural, grazing, and wood harvesting practices and reduction of path management.

CRITERIA APPLIED:

Criterion B: **EOO:** 4,938 km^2 calculated with minimum convex hull in ArcGis 2.0
AOO: 24 km^2 calculated with a 2×2 km cell fixed grid
a) Number of locations: five (according to threat 7.3)
b) Continuing decline observed, estimated and projected in extent and/or quality of the habitat (iii)
Category: EN B1ab(iii)+2ab(iii)

Criterion D: Number of mature individuals <1,000
Category: VU D1

Red List Category and Criteria (National Assessment)

EN	**Endangered**	**EN B1ab(iii)+2ab(iii)**

Rationale for the assessment: In Italy, *V. jordanii* is listed as Endangered under Criterion B due to its reduced EOO (4938 km^2) and AOO (24 km^2), the number of locations (5) considering the serious threat posed by habitat loss, and a continuing decline of the habitat as result of land abandonment. Populations from NE Italy are isolated from those of the Balkans while the NW Italian population is close to France, where the species is considered rare; therefore, also considering the dispersal strategy, downlisting was not applied.

Previous assessment: previously listed at national (Italy) level as EN (Conti et al. 1997); at a global level the species was not evaluated previously (NE; IUCN, 2016).

Conservation actions: In France, *V. jordanii* is considered a rare species, protected at the regional level in both regions where it occurs (i.e., Provence-Alpes-Côte d'Azur and Rhones-Alpes); it is included in the Provisional List of the Red Book of Endangered Species of France (Olivier et al. 1995). In Italy, it is protected by Regional Law 28/2009 of the Liguria administrative region. Seeds from the Ligurian population

are stored in the Laboratorio per la Conservazione della Diversità Vegetale Ligure (Ventimiglia, Italy).

Conservation actions needed: further monitoring and research activities are recommended in order to better understand the distribution, reproductive biology, and population trend of the species. *V. jordanii* is favoured by actions aimed at maintaining habitat mosaic, reintroduction of traditional grazing activities, and path management.

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